

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
4 November 2004 (04.11.2004)

PCT

(10) International Publication Number  
**WO 2004/094960 A2**

(51) International Patent Classification<sup>7</sup>: **G01F 1/66**

Center, 3-2, Asahigaoka 4-chome, Hino-shi, Tokyo 1910065 (JP).

(21) International Application Number:  
PCT/JP2004/005590

(22) International Filing Date: 20 April 2004 (20.04.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
2003-115333 21 April 2003 (21.04.2003) JP  
2003-168911 13 June 2003 (13.06.2003) JP  
2003-271779 8 July 2003 (08.07.2003) JP

(71) Applicant (for all designated States except US): **TEI-JIN PHARMA LIMITED** [JP/JP]; 1-1, Uchisaiwaicho 2-chome, Chiyoda-ku, Tokyo 1008585 (JP).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **FUJIMOTO, Naoto-shi** [JP/JP]; c/o Teijin Pharma Limited, Tokyo Research

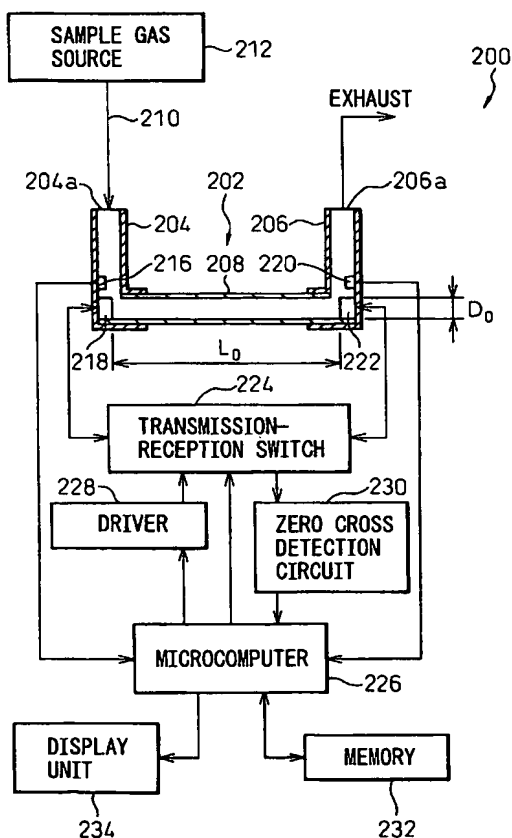
(74) Agents: **AOKI, Atsushi** et al.; A. AOKI, ISHIDA & ASSOCIATES, Toranomom 37 Mori Bldg., 5-1, Toranomom 3-chome, Minato-ku, Tokyo 1058423 (JP).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Continued on next page]

(54) Title: **ULTRASONIC APPARATUS AND METHOD FOR MEASURING THE CONCENTRATION AND FLOW RATE OF GAS**



(57) Abstract: **ABSTRACT** An ultrasonic apparatus measures the concentration and flow rate of a sample gas by calculating a possible propagation time range on the basis of the gas temperature, determining whether or not the phases at which two first trigger signals, respectively generated on the basis of forward and backward waveforms of the ultrasonic waves, coincide with each other, processing the zero-cross signals so that the phases coincide with each other, obtaining reference zero-cross time instant by calculating mean value of the forward and backward zero-cross time instants, obtaining an ultrasonic reception point by subtracting an integral multiple of the cycle of the ultrasonic waves so that the results of the subtraction falls into a possible propagation time range and estimating the ultrasonic propagation time on the basis of the ultrasonic reception point.



Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Published:**

- *without international search report and to be republished upon receipt of that report*